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BACKGROUND

The Washington State Department of Natural Resources (DNR) is the trust manager for 1.4 million acres of forested trust land in western Washington. The Legislature is the trustee and has directed DNR to serve as trust manager. This Final Environmental Impact Statement (Final EIS) is central to an environmental evaluation of sustainable forestry policies for these forested trust lands.

The overwhelming majority of the lands included in the sustainable harvest calculation are held in trusts created by federal and state laws. Although the management of these trusts provides many benefits to all the people of Washington, DNR has a clear legal duty of undivided loyalty to each separate beneficiary. Providing financial support is one of several legal trust land management responsibilities. Money goes to the beneficiaries (public schools, counties, public universities, local junior taxing districts, and others), who have received more than \$4.55 billion since 1970. In addition to trust obligations, DNR is subject to a number of federal and state statutes that protect public resources and provide public benefits. To fulfill these mandates, there are governing policies and procedures for management of forested trust lands. The Board of Natural Resources (Board) sets the major policies for forested trust lands. DNR develops administrative procedures (see Appendix C, Overview of Policies and Procedures) to effectively and efficiently implement Board-approved policies.

The sustainable forest analysis in the Final EIS presents policy choices to the Board in a set of Alternatives. All the Alternatives would also produce a certain level of timber harvest. The sustainable harvest analysis creates an understanding of the conservation benefits of the policy choices in each Alternative and the anticipated levels of sustainable timber harvest. A computer model is used in this analysis. The model was not specifically designed to provide information for an environmental analysis; however, the model outputs provide useful information that can illustrate expected impacts from the Alternatives. This environmental analysis uses both qualitative and quantitative information to assess potential environmental impacts. The analysis also relies on information generated during the State Environmental Policy Act (WAC 197-11) public involvement processes.

ENVIRONMENTAL IMPACT STATEMENT PROCESS

The sustainable forestry calculation is a “non-project action” under the State Environmental Policy Act. Non-project actions include the adoption of plans, policies, programs, or regulations that contain standards for controlling the use of the environment or regulating future actions. Site-specific analyses under guidance of the State Environmental Policy Act will occur for “projects” such as thinning, road construction, or other forest management activities that constitute a governmental action subject to the State Environmental Policy Act.

In this Final EIS, six Alternatives are examined for the management of 1.4 million acres of forested trust land in western Washington. The Alternatives represent a range of policy choices, and the Preferred Alternative represents the Board’s policy preference for how the



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forested trust lands are to be managed. As required by the State Environmental Policy Act, the Alternatives are examined using reasonably available information to assess their potential significant adverse environmental impacts.

This Final EIS examines six Alternatives to sustainable forest management on forest trust lands in western Washington. All of forested trust lands considered in this Final EIS are included in DNR's Habitat Conservation Plan (HCP). A Final EIS on DNR's HCP was published in 1997 and the Board adopted the HCP in 1997. All the anticipated effects of the proposed Alternatives in this Final EIS on sustainable forest management fall within the range of that HCP Final EIS.

The State Environmental Policy Act creates an open process to gather public input about governmental actions (e.g., sustainable forestry) before final decisions are made. The State Environmental Policy Act process includes a number of steps in which public input is gathered and considered for subsequent environmental analysis. The information-gathering process started with DNR issuing a Determination of Significance and Scoping Notice followed by public scoping meetings held early in 2002.

Purpose and Need

This proposal is to evaluate options for long-term sustainable forest management and to recalculate a sustainable harvest level for western Washington forested state trust lands. This is necessary because state law requires DNR to periodically adjust the acreages designated for inclusion in the sustained yield management program and calculate a sustainable harvest level. In other words, DNR is required to re-state how much timber will be harvested over the next decade (Revised Code of Washington (RCW) 79.10.320).

Specifically, the purposes of the proposal are:

1. To incorporate new information into a new model to re-calculate the decadal sustainable timber harvest level (for western Washington) under current DNR policy and federal and state laws.
2. To permit the Board to evaluate any policy changes after a number of policy Alternatives have been modeled and analyzed through an Environmental Impact Statement.

The next step was to identify Alternatives in a Draft EIS. The six Alternatives include a No-Action Alternative. The Board did not select a Preferred Alternative for the Draft EIS; the objective of this approach is to allow the public involvement process to provide additional information prior to selecting a Preferred Alternative. Following the release of the Draft EIS, the public input process included public meetings, an extension of the formal comment period beyond the legally required minimum, and workshops with the Board. All Board meetings were public, and were often televised.

Following the close of the comment period and the Board workshops, the Preferred Alternative was selected and is now being analyzed in this Final EIS. The selection process was based on:

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- Public comments on the Draft EIS;
- Public comments offered at regular monthly Board meetings;
- Public comments on the selection of a Preferred Alternative;
- Additional analyses provided by DNR staff at Board request; and
- The Draft EIS analysis.

The Board is to review the Final EIS and ultimately choose whether to accept the policy choices presented in the Preferred Alternative. These policy choices will form the direction for sustainable forestry for 1.4 million acres of forested trust land in western Washington. Policy changes will be implemented through the Board's adoption of a Preferred Alternative. Concurrently, with the Board's adoption of a Preferred Alternative, DNR's administrative procedures and tasks will be adjusted to reflect the choices made in the approved Final EIS Preferred Alternative.

Development of the Alternatives

At the January 2002 Board of Natural Resources meeting, prior to the release of the Determination of Significance and Public Scoping Notice according to the State Environmental Policy Act, the Board set the sideboards for the evaluation of policy Alternatives. The Board specified that Alternatives and components of Alternatives were to meet the DNR's legal and policy mandates (including federal and state laws), the Trust Mandate, and the objectives of the Habitat Conservation Plan. Alternatives that did not meet one or more of these objectives, or the purpose and need of the proposal, were not evaluated. These sideboards are consistent with the requirements of the State Environmental Policy Act.

The design of the six Alternatives was based on information collected from the public during the scoping period, discussions with the Board, and discussions with a Technical Review Committee (see Appendix B for list of members). Information was also used from the preliminary computer models and associated results presented to the public (July 2002) and the Board (August 2002).

The final set of six Alternatives reflect current management (Alternative 1), the 1997 Habitat Conservation Plan intent (Alternative 2), and four additional Alternatives that meet the Board's purpose. The intent of the six Alternatives was to examine a broad range of policy expectations that demonstrate passive, active, and innovative approaches to forest management. The six Alternatives, not including a Preferred Alternative, were analyzed in the Draft EIS that was released on November 10, 2003.

Development of the Preferred Alternative

The Board used public comments, staff reports, model information, and Board-generated criteria in addition to the Draft EIS to select a Preferred Alternative. The Preferred Alternative is now being reviewed along with the other five Alternatives in this Final EIS.



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There are three primary ways the Board received public input: 1) from direct testimony to the Board, 2) from written material submitted directly to the Board, and 3) from the Draft EIS comments. The Board typically hears public testimony on subjects of interest to the public at every monthly Board meeting. As the Draft EIS was being developed and subsequent to its publication, the Board heard testimony at its regular monthly meetings from citizens, interest groups, and professionals regarding the development of a Preferred Alternative. The comments received during the Draft EIS comment period came from 700 groups and individuals, and included 4,500 individual comment statements. The comments are summarized and addressed in this Final EIS (see Appendix G).

Staff reports in addition to the Draft EIS included technical reports and Board presentations (available on the Web at <http://www.dnr.wa.gov>). Technical reports were presented regarding the social dimension of the Board decision process that included Public Opinion Research, a report on Socioeconomic Resiliency (Daniels 2004), and a statewide opinion poll.

Staff reports also incorporated computer model results that characterized the results of the various Alternatives in terms of projected volume flows, changes in forest inventory level, changes in habitat (characterized as forest structure), and net and gross cash flows. Forest structure includes the number and size of live trees, standing dead trees (snags) and down woody debris. Describing a forest in terms of its structural conditions allows for an improved description of a forest's ecological condition because forest stand structure is related to ecological functioning. The stages used in this analysis are adapted from three principal sources: Brown (1985), Carey et al. (1996), and Johnson and O'Neil (2001). Forest structure analysis focused on several items of public concern, among them were;

- Forest Health – Changes to relative forest stand density as an indicator of stand vigor and fire risk as it relates to harvest intensity.
- Old Forest – Acres of forest with old forest stand structure characteristics.

Concurrently and on an ongoing basis, DNR worked with the Technical Review Committee (see Appendix B), seeking its help to independently evaluate core assumptions used within the computer simulations.

After the release of the Draft EIS, the Board defined their decision criteria and created a table with important criteria in columns and key policy questions in rows. This table or matrix aided the Board's discussions. DNR staff helped the Board complete the matrix by using computer runs and reports to fill in the needed information. The information was qualitative in nature and was developed over time in collaboration between DNR staff and the Board (see Section 2.4.1.2 and Appendix F).

The Board refined their key outcomes and developed policy direction and principles to direct the development of a Preferred Alternative. The policy direction was titled "Sustainable Harvest Calculation Management Principles and Objectives" (Principles and

¹ Available on the Web at <http://www.dnr.wa.gov/htdocs/fr/sales/sustainharvest/sustainharvest.html>

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Objectives), and was ultimately attached to Board Resolution 1110 that described the Preferred Alternative (see Appendix B). The Principles and Objectives included two significant core outcomes that would ultimately be incorporated into the Preferred Alternative:

1. Active forest management on an increased on-base acreage; and
2. Broader economic, conservation, and other public benefits consistent with fiduciary responsibilities.

On February 3, 2004, DNR staff used the Board's direction contained in its Principles and Objectives and the Board's discussion of the decision matrix to create the Preferred Alternative. This Alternative appeared to meet the Board's policy criteria. Implementation considerations were discussed and an economic analysis of the potential Preferred Alternative was presented on February 17, 2004. After further deliberation, the Board voted unanimously on the components of the Preferred Alternative and incorporated its elements in Resolution 1110. This resolution directs DNR to prepare a Final EIS using the Preferred Alternative, and incorporated by reference the Principles and Objectives.

Changes that Appear in the Final EIS

There are changes and additional analysis in the Final EIS that resulted primarily from a review of comments received during the Draft EIS process. Additional analysis was completed in a number of areas; they include additional analysis regarding northern spotted owl population changes, roads, public utilities and services and cumulative effects. The discussion of these topic areas is contained in Sections 4.4, 4.6, 4.11, and 4.15, respectively. Three changes incorporated in the Final EIS are described below. They are:

- Changes related to the Preferred Alternative,
- Changes to the computer model volume calculations for Alternatives 5 and the Preferred Alternative, and
- Adjustment of the forest structure models.

Draft EIS Alternative 6 Formed the Basis for the Preferred Alternative

The development of the Preferred Alternative by the Board of Natural Resources was based almost entirely on the policies and procedures of Alternative 6 as analyzed in the Draft EIS. The policy objectives of the Draft EIS Alternative 6 and the Preferred Alternative are very similar (see Appendix B, Section B.2), with the notable difference between the two Alternatives being the riparian management modeling assumptions.

As was noted in the Draft EIS, the riparian modeling assumptions of Alternative 6 did not clearly match the stated policy objectives, resulting in high levels of low-volume thinnings. The high levels of repeated-entry thinning activities raised numerous technical and policy questions by the Board, the Federal Services (National Oceanic and Atmospheric Administration Fisheries and U.S. Fish and Wildlife Service), and other key stakeholders, such as the Washington State Department of Fish and Wildlife.



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In response to public comments and based on the Board's direction during the development of the Preferred Alternative, modeling assumptions were updated to reflect the Board's interest in implementing a biodiversity pathways approach across as much of the land base as possible, and implementing a more moderate level of riparian restoration activities. These considerations described the evolution of the Draft EIS Alternative 6 into the Preferred Alternative in this Final EIS.

Modeling Updates

Since the distribution of the Draft modeling results on June 25, 2003 and the Draft Environmental Impact Statement (Draft EIS) in November 2003, DNR has made a series of updates to the modeling process. These updates were made in part as a response to comments made by DNR region field staff and by public comments on the Draft EIS. Two areas of the modeling were updated: 1) the estimates of saleable timber volume (in Scribner board feet), and 2) the stand development stage modeling.

The update to the estimates of saleable volume, particularly for the value-based Alternatives (Alternative 5 and the Preferred Alternative; see Appendix B for Technical Notes) was in response to concerns from DNR field staff that the estimated yields were too high. Reviews of the modeling processes and estimates led to changes in how DNR estimated the growth and yield and inventory characteristics of existing older forest stands. These updates to the growth and yield aspects of the value-based models, detailed in Appendix B, resulted in the need to review the logic of the stand development stage modeling.

In addition, public comments on the Draft EIS and from the technical review committee suggested that the stand development stage modeling reported in the Draft EIS accelerated stands too quickly through the development stages. This trend was particularly noted for forest stands on a natural, no-management pathway. The stand development stage classification system was reviewed and changes were made to the system to reflect a more realistic prediction of stand development under a no-management scenario. The details of the changes are in Appendix B. These changes were incorporated into the modeling of the Alternatives presented in this Final EIS.

Modeling Uncertainty

Forest management models provide a useful way to generate information that compares Alternative management strategies for decision-making. For complex and interrelated problems, such as policy development related to the management of forests, models provide a tool by which decision-makers can explore and discover their choices. Models do not supply definitive answers; rather, they provide information useful for developing policy and implementation plans.

Models have a number of uncertainties, which often are a product of the necessity to simplify reality. Three general areas of modeling uncertainty are recognized with regard to the estimates of: 1) saleable timber volume (Scribner board feet), 2) the available harvestable area, and 3) the change in forest conditions from one stand development stage

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to another. Uncertainties are managed in the modeling process by making assumptions. Modeling assumptions are developed based on the level of risk associated with a modeling output. When the information is important to decision-makers, the level of risk is higher and more attention is paid to the associated assumptions related to the outputs. However, while more development about the assumptions may occur, the primary purpose of the model is still exploration and discovery of management options.

Implementation Considerations for the Preferred Alternative

The Alternatives identified the potential of the forested trust lands to produce financial, ecological, and social benefits. To achieve the potential of any of the Alternatives, there are a number of operational and administrative considerations. For example, Alternatives that demonstrate higher timber harvest levels than today, such as the Preferred Alternative, will require additional foresters and specialists to successfully implement the Alternative. Therefore, the ability to hire, train, and pay for these extra staffing needs and other operational considerations is part of the implementation of an Alternative.

Recognizing that a transition period would likely be needed to reach a higher harvest level, the Board of Natural Resources directed the DNR to “present an analysis....that identifies hiring, implementation timelines and cash flow necessary to transition to the Preferred Alternative management practices and associated harvest levels. The Department is directed to prepare a Preferred Alternative that shall meet an average annual harvest target of 636 million board feet as soon as possible” (Board of Natural Resources Resolution 1110). This unanimously voted resolution also directed DNR to start the Final Environmental Impact Statement (Final EIS).

The Final EIS analyzes environmental impacts of a first decadal harvest of 6,360 million board feet for the Preferred Alternative. The transition schedule presented to the Board shows a total of 5,900 million board feet, with a mean annual first decadal level of 590 million board feet per year.



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ENVIRONMENTAL IMPACT STATEMENT ALTERNATIVES

The following Alternatives represent sustainable forest management in various forms. Each Alternative provides a different mix of benefits and impacts while still meeting the Board's specified sideboards. A table of the policies, procedures, and tasks that are referenced here can be found in Appendix C, Table 2.6-1.

Alternative 1 – No Action (Current Operations)

Alternative 1 represents the Board's existing policies and DNR's forest management strategies as indicated by the DNR Forest Resource Plan, 1997 Habitat Conservation Plan, DNR procedures and tasks, current DNR operations, and all current federal and state statutes. This Alternative represents an estimate of continued management of forested trust lands with current management strategies. Under this Alternative, projecting the status quo into the future represents uncertainties, such as how DNR would manage riparian areas or marbled murrelet habitat in the future. Therefore, in the case of riparian areas and marbled murrelet habitat, current strategies of deferral are projected indefinitely.

Alternative 2 – Habitat Conservation Plan Intent

Alternative 2 represents existing Board-approved policies and forest management strategies as defined by the DNR Forest Resource Plan, 1997 Habitat Conservation Plan, and current federal and state statutes. It does not include those interim DNR procedures and tasks from Alternative 1 that have not been approved by the Board. Management under this Alternative would implement the Habitat Conservation Plan as originally negotiated with the Federal Services in 1997.

Alternative 3 – Combined Ownerships

Alternative 3 represents existing Board-approved policies (except Policy No. 6 on Trust Ownership Groups), forest management strategies defined in the DNR Forest Resource Plan, the 1997 Habitat Conservation Plan, and current federal and state statutes.

"Combined Ownerships" refers to a change in Forest Resource Plan Policy No. 6 that defines how to group the forested trust lands when applying the even-flow requirement in Policy No. 4.

Alternative 4 – Passive Management Approach

Alternative 4 represents managing forested trust lands in western Washington with passive management approaches to provide increased conservation and habitat protection while producing revenue. This approach maintains the 1997 Habitat Conservation Plan objectives, the DNR Forest Resource Plan, and current federal and state statutes. "Passive management" refers to a land management approach that allows forest growth and structural development processes to occur with little silvicultural (cultivation of trees species) activity.

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Alternative 5 – Intensive Management Approach

Alternative 5 represents managing forested trust lands in western Washington with emphasis on revenue production on lands that are not dedicated to habitat conservation. It maintains 1997 Habitat Conservation Plan objectives and strategies, Forest Resource Plan (with exception of proposed changes) guidelines, and meets current federal and state statutes. “Intensive or active management” refers to a land management approach that accelerates forest growth and structural development processes through greater use of silvicultural activities.

Preferred Alternative – Innovative Silvicultural Management

The Preferred Alternative represents managing forested trust lands in western Washington using a mix of “innovative silvicultural management” techniques in habitat areas and current silviculture techniques in lands that are not focused on habitat conservation. This approach attempts to integrate habitat and revenue generation objectives while maintaining the current Habitat Conservation Plan approach, adhering to the Forest Resource Plan policies, and meeting current federal and state statutes. The Preferred Alternative incorporates increased silvicultural activity designed to accelerate forest growth and structural development processes.

Features that Vary Among Alternatives

The six Alternatives feature changes to policies, procedures, and implementation strategies, which are summarized below, and are also presented in table form in Chapter 2 (Table 2.6-1).

Ownership Groups

Currently there are 24 ownership groups. This current organization is retained in Alternatives 1 (No Action), 2, and 4. Two variations of current policy are proposed in Alternatives 3, 5, and the Preferred Alternative. In Alternative 3, all western Washington forested state trust lands are placed into one ownership group. In Alternatives 5 and the Preferred Alternative, the federal grant lands and Forest Board purchase lands (currently five ownership groups) are placed into one ownership group. This reduces the overall number of groups from the current 24 to 20. The change to ownership groups proposed in Alternatives 3, 5, and the Preferred Alternative would require a change to Forest Resource Plan Policy No. 6.

Timber Harvest Levels

Sustainable harvest can be scheduled and reported by several means, including volume, acreage, and economic value. Current Board of Natural Resources policy uses timber volume to report and schedule harvest. Alternatives 1 through 4 incorporate current policy, regulating harvest by volume. Alternatives 5 and the Preferred Alternative schedule harvest by economic value, requiring a change to Forest Resource Plan Policy No. 5. Harvest levels continue to be reported by volume under Alternative 5 and the Preferred Alternative,



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but the selection of stands for harvest will reflect their financial characteristics in order to optimize their economic value. Projected harvest levels for the first decade (2004-2013) are presented in Table ES-1.

Sustainable Even-Flow Timber Harvest

Timber harvest “even-flow” ensures that about the same amount of timber is available now and for future generations in perpetuity. Basically, “sustained yield” means that harvest (yield) does not exceed productivity (growth).

Alternatives 1 and 4 propose no change to the current implementation of Forest Resource Plan Policy No. 4. As such, even-flow is managed as a narrow band of variation, allowing the harvest level to vary by as much as 25 percent above and below the long-term harvest level.

Alternative 2 proposes a “relative” non-declining even-flow approach (this is similar to how the 1996 DNR sustainable harvest calculation examined allowable cut levels by ownership group). In this Alternative, timber harvests are allowed to increase over time, but declining harvest levels are avoided. The resultant harvest flow variation should therefore be less than Alternative 1.

Table ES-1. Summary of Projected Harvest Levels in Millions of Board Feet Per Year for First Decade (2004-2013) by State Trust, by Alternative

Trusts	Sustainable Forest Management Alternatives					
	1	2	3	4	5	PA
	First Decade Values in Millions of Board Feet per Year					
Agricultural School	9	9	8	12	11	17
Capitol Grant	34	40	47	29	58	58
Charitable/Educational/Penal and Reformatory Institution	14	15	17	12	16	19
Community College Forest Reserve	113	174	180	119	202	197
Common School and Indemnity	1	0.9	0.3	1	0.5	1
Escheat	2	1.7	2	1	1	1
State Forest Board Purchase	6	12	11	7	13	9
State Forest Board Transfer	23	22	28	23	27	32
Normal School	33	37	60	36	45	42
Scientific School	159	212	299	167	260	248
University - Original	1	0.4	1	1	1	1
University - Transferred	1	12	9	3	13	12
Total	396	537	663	411	648	636

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Alternative 3 expands the allowable variation in harvest level, controlling harvest fluctuation level as a wider band with no cessation or prolonged curtailment of harvest (formerly per RCW 79.68.030, re-codified at Laws of 2003, Ch. 334, sec. 555(3)). In this Alternative, there is little control on the harvest flow and therefore the variation in harvest levels between decades is likely to be greater than Alternative 1.

Alternatives 5 and the Preferred Alternative propose that timber harvest flows will not vary from a previous decade by more than approximately +/-25 percent. This approach uses the flow constraint approach from the University of Washington model (Bare et al. 1997).

Alternatives 2, 3, 5, and the Preferred Alternative would require a change to Forest Resource Plan Policy No. 4, the even-flow policy. If the Board selected a Preferred Alternative that schedules harvest level by value instead of volume, then Forest Resource Plan Policy No. 5, to schedule harvest by volume, would need to be amended accordingly.

Alternatives 2 to the Preferred Alternative would require revisions to Forest Resource Plan Policy No. 4 and DNR Procedure 14-001-010 (Determining Harvest Levels and Completing the Five-Year Action and Development Plan) and Forestry Handbook Task 14-001-020 (Developing the Draft Five-Year Action and Development Plan).

Silviculture

Silviculture is the art and science of cultivating forests to achieve objectives. The DNR uses a site-by-site approach for evaluating and implementing silvicultural treatments, based on site specific, rotational, or long term efficiency analysis return on investment, variable biological conditions, and social and physical limitations. Site-specific silvicultural prescriptions include activities such as site preparation, planting specific tree species at specified densities, fertilization, weeding of non-desirable species, and the harvesting of trees.

The principal silvicultural tool for altering the development pathway of a forest stand is a thinning. Thinnings are the cutting of live trees with the objective of leaving a specific numbers and types of trees that will lead towards a specific forest stand objective. DNR recognizes two broad categories of thinnings harvests based on forest stand objectives, although there are many variation between these two categories. One category is traditional or conventional commercial thinning, where trees are harvested for sale. These thinning usually results in about 70 percent of the initial stand remaining after harvest. The primary objective of this type of thinning is generally to produce a certain size timber product by the end of the rotation.

The other category of thinning activities relates to habitat restoration and revenue generation. Carey et al. (1996) coined the phased “biodiversity pathways” for the management of forest stands (and forested landscapes) to achieve objectives of conserving biodiversity and generating revenue through the application of silviculture that “accelerates” the development of structurally complex stands.



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Thinning forest stands in a way that encourages diverse development of the residual forest stand, i.e., the development of vertical and horizontal diversity of tree sizes, is achieved through techniques such as variable density thinning, where the stand is thinned to different residual tree densities. Heavy thinning treatments can typically result in less than 50 percent of the initial stand remaining after harvest. Also, some dominant trees are removed from the upper canopy to create sufficient space and gaps for the development of smaller trees (Carey et al. 1999). Without such thinning treatments in dense competitive exclusion stands, the density of dominant trees will not allow for the development of understory trees within the stand. Normally, these variable density thinning treatments, both heavy and light, harvest across the diameter classes. For these reasons, variable density thinning is not necessarily inferior economically to traditional thinning.

The principles of the biodiversity pathways approach to silvicultural treatment (based on Carey et al., 1996, page 23) are to:

1. Retain large-tree legacies (snags, large live trees and their epiphytes) and conservation of soil organic matter, seed banks, coarse woody debris, and understory vegetation at harvest;
2. Minimize site preparation, but under-plant widely spaced, site-appropriate coniferous species to supplement natural regeneration of tree and shrub species;
3. Modify thinnings to retain patches and open up the forest canopy to encourage the development of a diverse and patchy understory that mimics that in old forests; and
4. Directly improve habitat quality by creating cavity trees and adding coarse woody debris in the form of felled trees.

Typically, a regeneration harvest will occur at the time when landscape and stand objectives are met, i.e., revenue generation and/or structurally complex forest restoration. A regeneration harvest is the end-of-the-rotation treatment before the stand is re-planted or re-established through natural regeneration.

Silviculture in the Alternatives

Alternatives 1, 2, and 3 reflect traditional even-age silviculture that DNR practices currently. Planting densities are typically 300 to 400 trees per acre, but are tailored to site-specific conditions, species, and stand objective needs. Vegetation management and pre-commercial thinning are applied to stands, although economic objectives determine the intensity and frequency of these treatments. Fertilization and pruning techniques are limited. Commercial thinning harvests are normally from below and result in a residual (post harvest) stand that retains 70 percent of the initial pre-harvested stand. The minimum regeneration harvest age or the earliest age that a stand is considered eligible for regeneration harvest is determined by balancing tree volume growth and economic potential, as well as site conditions, species, and stand objectives. For example, a Douglas-fir stand on site class III ground (average quality) has a maturity criterion modeled at 60 years. At regeneration harvest, a minimum of eight live trees per acre is left in the residual stand.

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Silviculture in Alternative 4 is very similar to Alternatives 1, 2, and 3; however, the maturity criteria are lengthened. This has the effect of extending the rotation length of managed stands, whereby the stand may approach its culmination of growth (the end of the period of rapid growth). As an example, in Alternative 4, a Douglas-fir stand on site class III ground has a minimum regeneration harvest age of 80 years. At regeneration harvest, a minimum of eight live trees per acre is left in the residual stand.

In Alternative 5, the silviculture is more intensive. Planting densities are in the 300 to 400 tree per acre range with selected planting stock. Vegetation management and pre-commercial thinnings are applied and fertilization is used on selected sites. Stands are scheduled for regeneration harvest based on economic value and the maturity criteria are determined by the economic potential of stand growth. In this Alternative, the emphasis is on harvesting stands of trees when they have reached their maximum discounted economic value, expressed as net present value. As an example, in Alternative 5, a Douglas-fir stand on site class III ground has a minimum regeneration harvest age of 50 years. At regeneration harvest, a minimum of eight live trees per acre is left in the residual stand.

In the Preferred Alternative, the silviculture is a mix of current DNR silvicultural practices, more intensive silviculture and silvicultural approaches based on biodiversity pathways (Carey et al. 1996). For this Alternative, silviculture on forested trust Uplands with General Objectives reflects a mix of current DNR silvicultural practices (as in Alternative 1, 2, and 3) and more intensive approaches (as in Alternative 5). Commercial cohorts of trees (these are a group of trees of similar characteristics, such as age or size that exist in a stand) are typically managed with even-age silvicultural regimes. Planting densities typically range between 300 and 400 trees per acre, but maybe more or less as determined by the optimal pathway to achieve the objectives. Stands are also treated for vegetation management and pre-commercial thinning, as necessary. The maturity criteria are flexible and are determined by the landscape and stands objectives. Economic value of the growth potential of the stand is an important consideration; however, other aspects and conditions such as social and environmental factors will play a role in determining the stand's regeneration age. At regeneration harvest, a minimum of eight live trees per acre is left in the residual stand.

For the Preferred Alternative, silviculture in the Uplands with Specific Objectives, and Riparian and Wetland Areas is a mixture of current DNR silviculture (as in Alternatives 1, 2, and 3) and silviculture based on biodiversity pathways principles. Current DNR silviculture is assumed to be applied to hardwood-dominated stands, while biodiversity pathways silviculture is applied to conifer-dominated stands.

All of the Action Alternatives would require changes to Forest Resource Plan Policy No. 4, and to DNR Procedure 14-005-020 (Identifying and Prioritizing Stands for Regeneration Harvest).



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Northern Spotted Owl Habitat Management

Northern spotted owl habitat requirements are addressed in DNR's Habitat Conservation Plan through the provision of Nesting, Roosting, and Foraging Management Areas and in Dispersal Management Areas. The primary contribution of forested trust lands to the owl conservation effort comes through the protection and/or development of suitable habitat in the designated Nesting, Roosting, and Foraging Management Areas, and Dispersal Management Areas that complement federal reserves. The recommendations of the Northern Spotted Owl Recovery Team (USDI 1992) and the Northern Spotted Owl Advisory Group (Hanson et al. 1993) were taken into consideration during the designation of the Nesting, Roosting, and Foraging Management Areas, and Dispersal Management Areas. These areas were established primarily within 4 miles of federal lands. The designation was intended to provide habitat that makes a significant contribution to demographic support, maintenance of species distribution, and facilitation of dispersal. Based on the analyses conducted for the Habitat Conservation Plan (HCP), potential negative effects to individual northern spotted owls outside those areas were not expected to result in significant adverse effects to recovery efforts for the spotted owl population in western Washington (DNR 1996). In the Biological Opinion for the Habitat Conservation Plan (USDI 1997), harvest in certain non-strategic northern spotted owl circles was permitted. This landscape-based management approach continues to be a valid strategy in the face of changing population statistics for many reasons (See Section 4.4). In general, the strategy is based on the concept that areas with larger continuous habitat patches that support clusters of 20 or more northern spotted owls, are considered to have greater likelihood of being self-sustaining (Thomas et al. 1990).

Interim strategies were established following the adoption of the Habitat Conservation Plan (HCP) to phase-in permitted activities in northern spotted owl circles. DNR committed to provide additional protection for 56 northern spotted owl circles identified by the U.S. Fish and Wildlife Service until 2007. DNR Procedure 14-004-120 also provided interim protection from harvesting of suitable habitat within all status 1-reproductive northern spotted owl circles and within four specific northern spotted owl circles in southwest Washington until 1996. (Further information on northern spotted owl circles can be found in Section 4.4 of this document.) In Nesting, Roosting, and Foraging Management Areas and Dispersal Management Areas, the HCP requires DNR to identify at least 50 percent of the DNR forested trust land area as the "threshold habitat target" within each Watershed Administrative Unit (WAU). However, the HCP allows harvests in watersheds designated for habitat that do not yet contain the 50 percent threshold if they do not impact the 50 percent of the WAU that is either presently nesting, roosting, foraging, or dispersal habitat, or that is closest to becoming nesting, roosting, foraging, or dispersal habitat.

The Alternatives differ with regard to how they treat the 50 percent habitat target. Some allow only habitat enhancement until the Nesting, Roosting, and Foraging Management Area or Dispersal Management Area has reached 50 percent habitat. Other Alternatives allow activity in the areas not designated for the 50 percent habitat. Additionally, the Alternatives vary with regard to when they allow the permitted activity to take place in the

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northern spotted owl circles. Table ES-2 summarizes the management in of northern spotted owl circles and Nesting, Roosting, and Foraging Management Areas and Dispersal Management Areas under in the Alternatives.

Table ES-2. Northern Spotted Owl Alternative Strategies for Habitat Conservation

Policy, Procedure, Task Reference	Forest Management Alternatives					Preferred Alternative
	1	2	3	4	5	
Nesting, roosting, foraging and dispersal PR 14-004-120	No regeneration harvest if under 50 % habitat	Regeneration harvest allowed if under 50% habitat, but not in 50% that is or is designated to become habitat.	Regeneration harvest allowed if under 50% habitat, but not in 50% that is or is designated to become habitat.	Regeneration harvest allowed if under 50% habitat, but not in 50% that is or is designated to become habitat.	Regeneration harvest allowed if under 50% habitat, but not in 50% that is or is designated to become habitat.	Regeneration harvest allowed if under 50% habitat, but not in 50% that is or is designated to become habitat. Uses habitat improvement technique.
Northern spotted owl circles PR 14-004-120	Restricts activity until indefinitely in USFW circles. Interim circle protections remain.	Restricts activity until 2007 in USFW circles.	Restricts activity until 2007 in USFW circles.	Restricts activity until 2007 in USFW circles.	Restricts activity until 2007 in USFW circles.	Restricts activity until 2007 in USFW circles.
		Interim Circle protections removed.	Interim Circle protections until 2007 except OESF	Interim Circle protections until 2007 except OESF	Interim Circle protections until 2007 except OESF	Interim Circle protections until 2007 except OESF
			SW Wash until 2006	SW Wash until 2006	SW Wash until 2006	SW Wash until 2006

Notes:

1/ Biodiversity management as described by Carey et al. 1996

OESF = Olympic Experimental State Forest

USFWS = U.S. Fish and Wildlife Service SW = Southwest

Old Forest Components

“Old forests,” their definition, components, extent, and management are important issues in sustainable forestry management. Old forests are defined as a forest inventory unit with old growth structure.

Alternative 1 includes all provisions for old forest management in current operations, requiring no changes to policy or procedure.

Alternative 2 to the Preferred Alternative maintains two of the four basic components of current management—Old Growth Research Area deferrals as defined in Forest Resource Plan Policy No. 14, and the management for old forest conditions in the Olympic Experimental State Forest as defined in the Habitat Conservation Plan (page IV.88).



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Alternative 2 to the Preferred Alternative does not maintain the “50/25” strategy (see Chapter 2, Section 2.6.3) and would require changes to Task 14-001-010 when the Board adopts one of these Alternatives. In addition, Alternatives 2 to the Preferred Alternative replace the required legacy and reserve tree level requirements in Procedure 14-006-090 with language implementing the protection of structurally unique trees and snags described in the Habitat Conservation Plan (pages IV.156-157). Under Alternatives 2 to the Preferred Alternative, this legacy and reserve tree procedure would change from the current procedure requiring retention of 7 percent of the trees in regeneration harvest units to the Habitat Conservation Plan (HCP) strategy of retaining a minimum of eight trees per acre.

Alternative 4 proposes to defer for the entire planning period all standing old forests with an age equal to or greater than 150 years in the 2001 forest inventory. This is an age-based criterion without structural considerations found in the HCP’s definition of old forests.

Rather than specifically preserving all forests of a certain age existing today, Alternatives 5 and the Preferred Alternative propose that 10 to 15 percent of each Westside HCP Planning Unit be targeted as old forests based on structural characteristics. In addition, the Preferred Alternative requires the DNR to use retention of existing old growth stands (as defined in the HCP) as a priority in achieving these targets.

Adoption of these features by the Board would require changing Forest Resource Plan Policy Nos. 3 and 14.

Riparian and Wetland Areas

The Riparian and Wetland Management Zone strategies in the Alternatives are based on the management objectives described in the Habitat Conservation Plan (HCP). The Board of Natural Resources and DNR are not deliberating a decision with regard to riparian management as part of this sustainable harvest calculation. Parallel with this analysis, the DNR and the Federal Services are undertaking development of a riparian strategy. However, this riparian strategy has not been completed. The analysis included within this sustainable harvest calculation, therefore, examines the effects of a reasonable set of estimates of future procedures that meet the HCP riparian management objectives. Frequency and intensity of management within these zones vary among the Alternatives.

None of the Alternatives proposes changes to the plan’s Riparian Management Zone designations or basic guidelines for management within those zones under the HCP. No changes are proposed for Wetland Management Zones in any of the Alternatives.

Currently, no harvest activities are conducted within designated Riparian Management Zones, except road and yarding corridor crossings. Activities are allowed within the Wetland Management Zones as identified in Procedure 14-004-110. These guidelines are assumed unchanged in Alternatives 1 and 4.

Alternatives 2, 3, 5, and the Preferred Alternative instead provide a range of restoration and silvicultural activities that may be considered under the final riparian procedure. Riparian

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ecosystem restoration encompasses a range of activities that must be site-specific and tailored to the physical and biological conditions at a particular site.

As defined in the HCP (page IV.62), disturbance of areas of potential slope instability, including those within riparian areas and wetlands, is restricted to light access development and maintenance (road and yarding corridors).

In Alternatives 2 and 3, restoration and silvicultural activities are assumed to occur at a moderate intensity, that is to say, less than 1 percent per year of the total Riparian and Wetland Area may have a silvicultural treatment. Most of these treatments are assumed to be traditional thinnings (see Chapter 2, Silviculture) within the outer Riparian Management Zones. The outer zones are the minimal-harvest zone and the low-harvest zone (HCP, page IV.70). These light thinnings normally retain at least 70 percent of a forest stand after thinning.

In Alternative 5, restoration and silvicultural activities are allowed at moderate intensity where less than 1 percent per year of the Riparian and Wetland Area may be treated with a restoration activity. Alternative 5 assumes similar thinning treatment to Alternatives 2 and 3.

The Preferred Alternative assumes that the restoration treatments in the outer Riparian Management Zones will be a combination of traditional thinnings, patch cuts of $\frac{1}{2}$ to 2 acres in size, and biodiversity pathway approaches. Unlike the Draft EIS Alternative 6, where the restoration treatments could be characterized as extensive, the Preferred Alternative treats fewer acres per year: less than 1 percent per year of the total Riparian and Wetland Area. The change from the Draft EIS Alternative 6 to the Preferred Alternative was in response to the Board's direction and public comments.

Summary of Environmental Consequences

This section summarizes the environmental analysis detailed in Chapter 4 of the Final Environmental Impact Statement (EIS), which examines the effects of proposed changes to the current policy and procedures, under each Alternative. Conclusions are based on reasonably available data and generally qualitative analyses, supported by quantitative data where available and appropriate. Computer model outputs provide useful information that illustrate expected impacts of the Alternatives. The Forest Resource Plan and the Habitat Conservation Plan (HCP) Environmental Impact Statements provide useful benchmarks for evaluating the effects of the 2003 sustainable harvest calculation level.

Potential relative risks are identified and discussed for the resource areas and are used to rank the Alternatives. The potential relative risks and rankings express the potential for environmental impacts to occur.

None of the Alternatives would result in any probable significant adverse impacts to any of the resource areas, relative to current conditions, beyond those anticipated in the HCP. A relatively high risk does not necessarily equate to a probable significant adverse impact when compared to another Alternative or to existing conditions.



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Forest Structure

This section analyzes the environmental effects on forest structure, old forests, forest health, carbon sequestration, and threatened and endangered plant species. The analysis examines the current and proposed changes to policy and procedures under the different Alternatives. This analysis also assesses relative risks among Alternatives that are illustrated using modeling outputs.

Alternatives 1 and 4 would provide more old forest and would entail less risk of adversely affecting threatened, endangered, and sensitive plant species than the other Alternatives. However, Alternatives 1 and 4 would result in more dense forest stands that achieve lower individual tree growth rates and are more susceptible to damage from insects and disease. Alternative 2 and the Preferred Alternative are ranked intermediate in terms of their overall relative risk of causing negative environmental impacts. The Preferred Alternative has a higher risk associated with it over the short-term but in the long-term ranks highest in the development of structurally complex forest stands. Both the Preferred Alternative and Alternative 2 would require an intermediate level of investment for successfully implementing their management strategies and achieving the projected level of harvest.

Alternatives 3 and 5 would have fewer policy limitations for stand management and timber harvest and would apply more intensive management strategies than the other Alternatives. Management proposed under Alternatives 3 and 5 would result in more harvest area and forests that are less susceptible to insect and disease damage.

Alternative 5 and the Preferred Alternative would entail more relative risk of adversely affecting threatened, endangered, and sensitive species of plants due to more harvest and harvest-related disturbance.

Riparian

The distribution of stand development stages within Riparian Areas suggests that, compared to historic unmanaged stands, many moderate to large streams on western Washington forested state trust lands may have reduced levels of multiple riparian functions because of decreased levels of large, fully functioning stands. Riparian areas for smaller streams may have adequate shade and size for potential instream large woody debris, but may be deficient in decadent features and other riparian functions important to wildlife and other riparian-dependent species. Many riparian areas currently contain moderate to high levels of early stand development stages, and are not likely to change in the near future. Thinning can reduce the time necessary to produce very large trees and reduce the time needed to increase stand complexity.

Removing trees within the Riparian Management Zone may temporarily reduce the level of some riparian functions, but the extent of the reduction depends on where trees are removed, site-specific conditions, the amount of trees removed, and the particular riparian function being considered (Washington Forest Practices Board 2001). Such near-term impacts would have to be considered against the potential to accelerate functional recovery. The degree to which moderate intensity timber management would affect near-

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term riparian function is uncertain. However, active forest management can change species and stand composition and accelerate the development of more complex stand structures (Carey et al. 1996). Such events would help to restore long-term riparian functioning but may have some short-term adverse effects.

Each Alternative proposes different levels of harvest activities in Riparian Areas (Table 4.3-2). During the remaining period of the Habitat Conservation Plan, Alternatives with lower levels of activity, such as Alternatives 1, 2, 3, and 4, are expected to have a higher proportion of Riparian Area with large and very large trees that are in competitive exclusion stages. In contrast, Alternatives with higher levels of active management, such as the Preferred Alternative, are expected to have more Riparian Area that will be fully functioning, or be on a trajectory towards full function. (Descriptions of these stand development stages are provided in Appendix B, Section B.2.3.) Regardless, riparian conditions are expected to improve under all Alternatives relative to current conditions. This is due to changes in stand structure, particularly increases in the amount of stand development stages that include large and very large trees, which are in moderate supply throughout much of the forested trust lands (see Figure 4.3-2). The rate of improvement in structurally complex forests overall is similar among most Alternatives, though the Preferred Alternative performs better through 2067. When looking at the two most complex stages of niche diversification and fully functional forests, the Preferred Alternative accounts for over 13 percent of Riparian Areas by 2067 compared to about 7 percent for Alternative 1.

Wildlife

None of the Alternatives, including the Preferred Alternative, propose changes to the northern spotted owl conservation strategy, as outlined in the Habitat Conservation Plan (HCP) on pages IV.1 to IV.19 and IV.86 to IV.106. The HCP Environmental Impact Statement (EIS) is incorporated by reference and relied on in this Final EIS. In addition, this Final EIS analyzes the Alternatives in light of the new information on northern spotted owl demography discussed in Section 4.4.3 of this document. The analysis also includes a comparison of the Alternatives using three criteria:

- changes in the amount of structurally complex forest ;
- the amount of timber harvest in areas designated as Nesting, Roosting, Foraging, and Dispersal Management Areas; and
- changes in the management of northern spotted owl circles.

Other policy and procedure changes under the Alternatives would influence the amount and distribution of wildlife habitat on forested trust lands. The Alternatives would vary in the timing and amount of forest structures they would create, but would not be expected to have any significant adverse environmental effects on wildlife.

The sustainable harvest calculation analysis uses the stand development stages to represent structural diversity and habitat values. (Descriptions of these stand development stages are provided in Appendix B, Section B.2.3.) Changes in the relative amount of forested habitat



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types are a product of varying rates and intensities of timber harvest under the different Alternatives. Appendix Table D-10 presents the modeled proportion of forested trust lands comprising ecosystem initiation, competitive exclusion, and structurally complex forests under each Alternative in the years 2013 (short-term) and 2067 (long-term). Competitive exclusion forests are the most common forest habitat type on forested trust lands, making up 68 percent of the total forested area (Table 4.4-1). Approximately 26 percent of this habitat type occurs in upland areas with general management objectives. Structurally complex forest makes up about 25 percent of the total area on forested trust lands (Table 4.4-1). In the short term and long term, the amount of structurally complex forest is modeled as increasing in all HCP Planning Units under all Alternatives

The structurally complex forests stages serve as a relative indicator of change in the amount of habitats of management concern. Several examples follow:

- Northern Spotted Owl - Throughout much of their range, northern spotted owls are strongly associated with forested areas that are classified as structurally complex in this Final EIS.
- Marbled Murrelet - The Marbled Murrelet Recovery Plan (USFWS 1997) identifies terrestrial (upland) habitat essential for marbled murrelet recovery. The Recovery Plan identifies additional areas on non-federal land where existing habitat should be protected because habitat in federal reserves is insufficient to reverse population declines and maintain a well-distributed population. In the state of Washington, such additional essential habitat occurs on state lands within 40 miles of marine waters. These areas are critical for improving the distribution of the population and suitable habitat, especially in southwestern Washington (USFWS 1997). Effects on forestlands within 40 miles of marine waters, therefore, are of particular concern in determining the effects of the Alternatives on marbled murrelet populations. Of the approximately 340,000 acres of structurally complex forest on western Washington forested state trust lands (Table 4.4-1), approximately 85 percent occur within 40 miles of marine waters (see Table D-16).
- Deer and Elk - The results from the Washington Forest Landscape Management Project (1996) indicated that the estimated carrying capacities for deer and elk are comparable when either timber production is maximized or when 30 percent of the watershed is maintained in a fully functional forest stage.

Forest in the competitive exclusion stages is currently the most abundant habitat type on forested trust lands. Under all Alternatives, the majority of timber harvest is expected to occur in this habitat type. Two processes would likely affect the amount of competitive exclusion forest: conversion to ecosystem initiation forest through high-volume timber harvest, and development into structurally complex forest through natural forest succession, as well as forest management activities such as thinning.

Model output data indicate that the amount of competitive exclusion forest on western Washington forested state trust lands would decline under all six Alternatives in both the short term and the long term (Figure 4.4-3). In the short term, results show very little

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difference in the amount of competitive exclusion forest among the Alternatives (Appendix D, Table D-10). Model outputs indicate that at the end of the planning period, by 2067, all Alternatives would reduce the amount of forestlands in competitive exclusion, ranging from 1 to 8 percent. Under Alternatives 1, 4, and 5, approximately 65 percent of forested trust lands would consist of competitive exclusion forest, while Alternatives 2, and 3 would result in about 64 percent. Under the Preferred Alternative, 60 percent of the forested trust lands would consist of competitive exclusion forest (Appendix D, Table D-10).

For the most part, decreases in the amount of competitive exclusion forest correspond to increases in the amount of structurally complex forest. This result suggests that many areas that currently sustain competitive exclusion forest would acquire the characteristics of structurally complex forest over time. The greatest long-term declines in competitive exclusion forest would likely occur under the Preferred Alternative, followed in descending order by Alternatives 1, 4, 5, 2, and 3. Declines in the amount of competitive exclusion forest would not be expected to result in any significant adverse effects to wildlife species overall. No wildlife species are found exclusively in competitive exclusion forests, and decreases in the amount of competitive exclusion forest would nearly be matched by increases in structurally complex forest.

Air Quality

None of the proposed Alternatives would create new policies or procedures related to air quality. Impacts related to air quality would result from the projected forest management activities associated with each of the Alternatives.

The Alternatives differ slightly in their effects to air quality, but none of the Alternatives has the potential for significant environmental impacts relative to current conditions, beyond those anticipated in the Habitat Conservation Plan Environmental Impact Statement. Air pollution from dust would be mitigated by dust abatement measures under all Alternatives, and the total amount of prescribed burning would likely continue to be below the level anticipated in the Habitat Conservation Plan.

Geomorphology, Soils, and Sediment

Significant increases in landslide frequency or severity and loss of soil productivity relative to current conditions, beyond those anticipated in the Habitat Conservation Plan (HCP) Environmental Impact Statement (EIS), are not anticipated under any of the Alternatives. Increased soil erosion may occur in certain intensely managed areas as road use increases. Further discussion of relative impacts among the HCP Planning Units and for individual watersheds is included in Cumulative Effects (Section 4.15). The Alternatives are ranked according to percent of uplands impacted per decade by intensity of harvest type (Table 4.6-8). By this ranking, Alternative 5 carries the highest potential overall relative impact, followed by Alternatives 2, 3, the Preferred Alternative, and 4 and 1.

The public comments requested that the Final EIS review the differences between Alternatives with regard to forest roads. Section 4.6 presents information relevant to road impacts. In general, it is not expected that the number of road miles or road density will



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vary as a result of the implementation of any of the proposed Alternatives. While the Final EIS Alternatives propose different harvest timings and locations, the basic road network statewide will evolve to the end condition, over time, virtually independent of which Alternative is chosen. Road spacing is mostly dependent on topography. Topography drives the type of logging system used to achieve the desired silvicultural objectives, which in turn dictates optimal yarding distance to road spacing combinations. This is illustrated by Table 4.6-3 (Chapter 4, Section 4.6), Road Density by Deferral Class under the Preferred Alternative in 2004. The table shows that there are small differences between road density in areas that would be deferred from harvest under the Preferred Alternative and the areas that would allow activity.

Road impacts for all the Alternatives should be well within the range anticipated by the HCP due to the relationship to the total acres harvested. As indicated in Table 4.6-4, harvest levels in each of activity types for each of the Alternatives are within those expected under the HCP and analyzed in the HCP Draft and Final EIS. The HCP Draft EIS (DNR 1996) analyzes effects related to sediment (p. 4-163) and stream flow (p. 4-170). Mitigation in the form of Riparian Management Zones, management for hydrologically mature forest in the significant rain-on-snow zones, wetland protection, and road management planning (identified above) are detailed in those sections.

The Washington Forest Practices Rules Final EIS (DNR 2001) also presents an analysis of the effects of sediment, peak flows, and roads in riparian areas and wetlands on water quality and on fish. A discussion of sediment is contained in Section 3.2 (p. 3-7), which discusses road surface erosion and road-related landslides. The evaluation of the Alternatives in this analysis offers the 2001 rules package that provides measures necessary to address impacts due to road-related sedimentation (p. 3-16). These mitigation measures include implementation of road maintenance and abandonment plans and the adaptive management program. In addition, Appendix F in the Final EIS for the Forest Practices Rules discusses the effects of road construction and maintenance and describes recommended and accepted practices for building and maintaining roads. It states that, “Roads built following Forest Practices Rules that provide specific direction and recommended Best Management Practices (BMPs) from the literature have the lowest risk of causing sediment delivery” (p. F-2). As stated above, all of the Alternatives will meet the requirements as specified in the Forest Practices Rules.

Hydrology

Procedure 14-004-060, which prohibits harvest of hydrologically mature forest in the rain-on-snow and snow zones where the mature forest type makes up less than 66 percent of these zones, would not change under any of the Alternatives. Consequently, significant changes in peak flows due to harvest activities would continue to be avoided under all of the Alternatives. The Habitat Conservation Plan Environmental Impact Statement (DNR 1997) provides more detailed analyses of the effectiveness of the measures laid out in Procedure 14-004-060 and other procedures in minimizing potential adverse effects to peak flows from harvest activities (see Sections 4.2.3, 4.4.2, and 4.8).

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Water Quality

None of the Alternatives would increase the risk of water quality degradation in the long term. Existing procedures adequately protect water resources. Short-term, localized sedimentation may increase in some areas immediately following harvest, but the vegetation in the inner and no-harvest portion of the Riparian Management Zones would prevent most sediment from entering streams. Over the long term, improved riparian function would likely lead to improved water quality on forested trust lands.

In the short term, additional planning and implementation resources would be required to prevent sediment delivery to streams as a function of greater harvest in the Riparian Management Zones under Alternatives 2 and 3, and, to a greater extent, under Alternative 5 and the Preferred Alternative. However, in the long term, riparian function across the land base is expected to improve more rapidly under the Preferred Alternative than any other Alternative proposed, as discussed in Section 4.3 (Riparian).

Wetlands

DNR Forest Resource Plan Policy No. 21 states, “the Department will allow no overall net loss of naturally occurring wetland acreage and function.” The procedure (PR 14-004-110 Wetland Management) governs harvest activities in and around wetlands and is not proposed to change under the Alternatives.

The approximate delineation method, an approved approach to determine wetland boundaries, primarily uses maps and aerial photographs. However, not all wetlands, particularly forested wetlands, are visible on aerial photographs. Also, the Habitat Conservation Plan and its Environmental Impact Statement acknowledge that wetlands less than 0.25 acre may be affected by forest management activities. Thus, the difference in environmental impacts to wetlands under the proposed Alternatives would be a function of the acreage to be harvested and the amount of related activities under each Alternative. Over all, Alternative 1 would result in the lowest level of disturbance (an average of 11 percent per decade), followed by the Preferred Alternative, Alternatives 4, 2, 3, and 5 (at 14, 15, 16, 17 percent, respectively). Alternative 5 would disturb the most acres, an average of 24 percent per decade, and would have the greatest affect on wetlands.

Fish

In general, the effects would be expected to follow those described in Section 4.3, Riparian Areas. Over the long term, all Alternatives would be expected to result in improved riparian and aquatic conditions for fish because of increased riparian function associated with continued growth or restoration of riparian stands. Larger and taller riparian tree stands with multiple canopy layers are expected to increase shade levels, functional in stream large woody debris, leaf and needle litter, and improvements to coarse and fine sediment input and hydrologic regimes. In part, this would result by recovery from current degraded conditions in many areas caused by practices prior to the Habitat Conservation Plan (HCP), rather than enhancement of natural conditions.



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Relative to Alternative 1 and other Alternatives, the Preferred Alternative is expected to have more beneficial effects by increasing the rate at which riparian stands transition to structurally diverse, fully functioning stands. However, the Preferred Alternative also includes more intensive management of riparian areas for habitat enhancement. Under the Preferred Alternative, management activities would include a moderate level of infrequent, but heavy thinning activities designed to promote structural diversity in competitive exclusion stands that currently dominate in Riparian Areas. The current and proposed policies and procedures are designed to avoid, minimize, and mitigate for forest management practices on forested trust lands that have the potential to adversely effect the aquatic habitat features described below. On a relative basis, the slightly higher activity levels proposed under Alternative 5 and the Preferred Alternative suggest a slightly higher risk of adverse effects from forest management activities if mitigation measures are followed. Regardless of Alternative, the potential for adverse effects appear to be within levels anticipated under the HCP.

Public Utilities and Services

This analysis considers the potential effects of the Alternatives on harvest volumes. Volume directly affects revenue to the beneficiaries, and some beneficiaries partially fund public utilities and services with timber revenue. This section also considers the potential effects of the proposed Alternatives on transportation infrastructure. The analysis uses the modeling outputs to inform the public and decision-makers of the relative differences in potential environmental impacts. This analysis also allows DNR to assess relative risks that are illustrated using modeling outputs.

The Alternatives provide a wide array of direct economic benefits to the beneficiaries. In other words, the relationship between the Alternatives is not consistent across all beneficiaries. Projected annual average harvest levels are, for example, highest for Agricultural School Grant lands under Preferred Alternative, but highest for University Grant lands under Alternative 5. This variation is also evident for state forestlands when projected harvest levels are viewed by county. Projected state forestland harvest levels are, for example, highest under Alternative 5 in Wahkiakum County, but highest under Alternative 3 in Skamania County. These modeling outputs do not provide precise harvest schedules, but they can represent a likely distribution of harvest levels over time at the county level. While they provide an indication of the possible distribution of harvest by county, it is difficult to predict what effect this variation would have on the built environment.

Potential effects on transportation infrastructure would vary by Alternative, with larger projected harvest volumes resulting in increased logging truck traffic. Alternatives with larger projected harvest volumes would, however, also result in more revenue available for maintenance and improvements to public utilities and services. Potential transportation impacts would occur within the context of total forest management activity within the state of Washington and surrounding regions. Current DNR harvests represent about 13 percent of total western Washington harvest. Logging companies harvesting timber from forested trust lands must meet Washington State Department of Transportation weight requirements

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and pay taxes that support road improvements. DNR regularly meets with local government officials and engineers to discuss the effects of logging-related traffic (DNR 1992b). These measures would help mitigate potential impacts associated with increased road traffic. As a result, none of the Alternatives is expected to result in any probable significant adverse environmental impacts on transportation infrastructure.

Cultural Resources

While there are relative differences among the Alternatives, none is expected to result in any probable significant adverse environmental impacts to cultural resources relative to current conditions. Forest Resource Plan Policy No. 24 requires protection of such resources and DNR is committed to consulting with Native American tribes and other interested parties about areas of cultural importance to them. These two forms of mitigation are expected to minimize risk to cultural resources.

Recreation

Environmental impacts on recreation resources are assessed in relation to harvest level. More intensive harvest would have a larger impact on the landscape, potentially affecting the quality of recreation experiences in adjacent and nearby areas. Potential effects on recreation may be mitigated on a case-by-case basis during operational planning prior to the initiation of harvest activities. Potential effects may be mitigated by employing harvest systems that minimize potential visual effects and by relocating or rerouting affected recreation facilities, particularly trails, as appropriate. All of the Alternatives would meet the requirements of DNR policies and procedures that address recreation and public access (Policy Nos. 25 and 29). As a result, none of the Alternatives is expected to result in any probable significant adverse environmental impacts to recreation.

The effects of the proposed Alternatives on fish and wildlife could, in turn, affect recreational fishing and hunting on forested trust lands. Fishing and hunting opportunities on forested trust lands could be positively affected to the extent that improvements in habitat and habitat suitability contribute to greater numbers of fish and game populations in some or all of the HCP Planning Units. The potential effects on fish and wildlife are discussed in more detail in Sections 4.10 and 4.4, respectively.

Scenic Resources

Lands managed for timber production under all Alternatives would be managed under DNR's visual management procedure (14-004-080), which seeks to minimize potential impacts to scenic resources by managing harvest activities with respect to sensitive viewshed areas. Potential visual effects associated with the proposed Alternatives may be mitigated on a case-by-case basis during operational planning prior to the initiation of harvest activities. Operational planning by DNR includes policies and procedures related to green-up (growing young trees for a specific time before adjacent trees may be cut), reforestation, and harvest unit size that contribute to the management of forested landscapes. As a result, none of the Alternatives is expected to result in any probable significant adverse environmental impacts on scenic resources.



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Cumulative Effects

Cumulative effects are defined under both a broad and narrow definition for this analysis. DNR recognizes that cumulative effects conditions are occurring and have the potential to occur in the future in watersheds where DNR manages forested trust lands. The analysis examines current forest conditions, wildlife habitats, fish, water resources, and potential impacts of future harvests. DNR's policies and procedures are in place and implemented to manage and reduce the risk of cumulative effects occurring. The Alternatives with higher levels of activities in the first decade, Alternative 5 and the Preferred Alternative have a somewhat higher risk of contributing to cumulative effects, especially related to water resources. However, all Alternatives implement various mitigation measures for cumulative effect to forest vegetation, wildlife, and water resources. These measures include, but are not limited to, implementation of the Habitat Conservation Plan (HCP) Riparian Management Zones, procedure for management of potential slope instability, visual area management, procedure for adjacency of regeneration harvest units, and leave trees strategy. The expectation is that the overall level of cumulative effects would be reduced under all Alternatives in the future due to the Board of Natural Resources' forest management policies; DNR's HCP and operational procedures in combination with Forest Practices Rules; the Northwest Forest Plan; and other regional programs, such as salmon recovery efforts (Salmon Recovery Funding Resource Board), and habitat conservation plans developed by private forestry companies (e.g., Plum Creek, Port Blakely, Simpson Timber, West Fork Timber) and utility companies (e.g., City of Seattle, Tacoma Water). These programs should reduce the potential for future cumulative effects by requiring that landowners do their share of mitigation and avoidance. All of the proposed Alternatives would be expected to provide effective mechanisms in policy and procedures to provide mitigation against cumulative effects where DNR manages a portion of the landscape.